

A NEW
IMPROVEMENT
In the ART of making the
True VOLATILE SPIRIT

TO F.
S. U. L P. H. U. R.

A N D

This is so plain, short, easie, and cheap a Method, that any Person, though unacquainted with Chemistry, may now prepare this powerful and so much wanted Remedy, at Home, at a small Expence; for his own private Use.

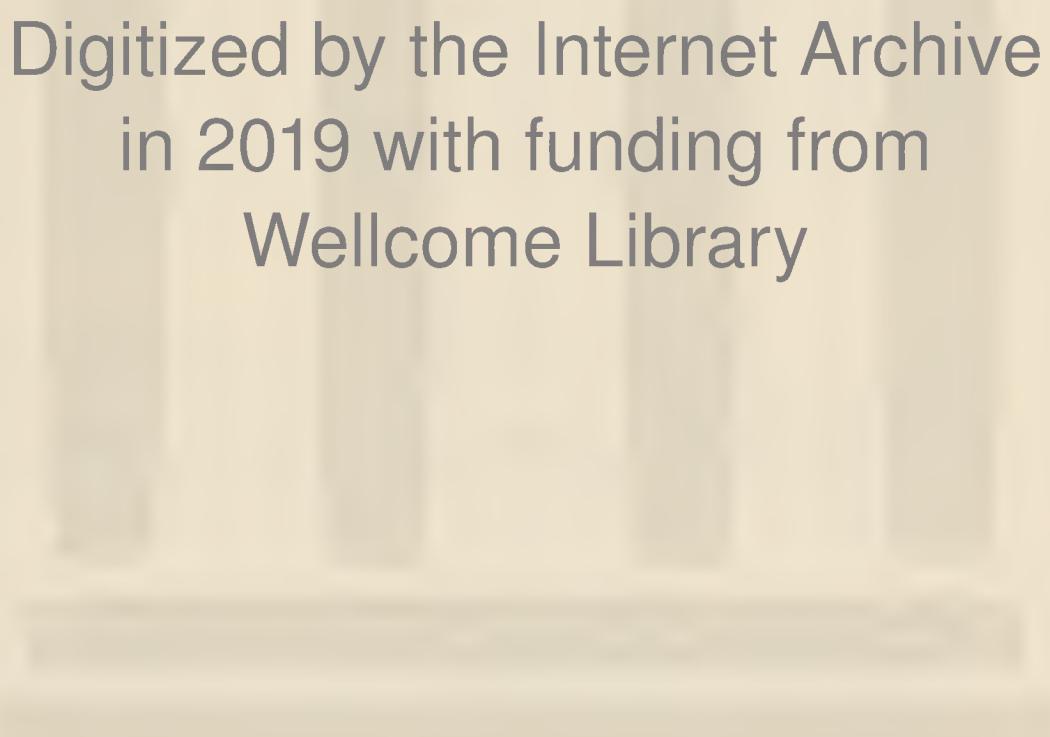
Dedicated to

CROMWELL MORTIMER, M.D.
Secretary of the Royal Society, and Fellow of
the Royal College of Physicians in London.

By ERHRAIM RINHOLD SEEHL.

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SEEHL, E. R.



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A NEW
IMPROVEMENT
In the ART of making the
True VOLATILE SPIRIT

OF
SULPHUR.

AND

This is so plain, short, easy, and cheap a Method, that any Person, though unacquainted with Chemistry, may now prepare this powerful and so much wanted Remedy, at Home, at a small Expence; for his own private Use.

Dedicated to

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T. C.

Cromwell Mortimer, M. D.

Secretary of the ROYAL SOCIETY,

A N D

Fellow of the Royal College of
Physicians in London.

Most honoured Sir,

WHEN I was favoured, some time ago, with the Conversation of some learned Members of your illustrious Society, the Difficulties of several Subjects of Importance were, in a great Degree, cleared up, among which was that of the *Brimstone*, and its Volatile Spirit: But the Time being too short fully to adjust the Difficulties on both Sides, about such an inexplicable Point, (as it has been hitherto reputed) and the said Gentlemen having received with Candour

The DEDICATION.
that short and oral Explication of my Experiments, and new Method of preparing the *Volatile Spirit of Sulphur*, I presumed, that it would not be disagreeable, if I set forth the Whole in Writing, and laid it before the Royal Society; which I have done accordingly.

But having a Mind, most worthy Sir, to present this Discourse also to the Publick, you will permit me to introduce it with the Ornament of your conspicuous Name.

I might have prefixed the Analytick and Synthetick Enquiry into Vitriol, a Mineral the nearest akin to Brimstone; but had I apprehended myself sufficient for such a Work, I could not have been persuaded to anticipate so much your learned Approbation of my present Experiments,
I am, SIR,

Your most obedient, and
Most humble Servant,

E. R. SEEHL.

T H E P R E F A C E.

TH E learned Physicians considering that a Volatile Acid was equally wanted, for the Success of their Practice in Alkalious Distempers, as the Volatile Alkali's, (of which there are several Sorts) are in Acid Diseases; and justly observing, that the Brimstone must, in all probability, be the most proper Subject for its Extraction, as having the most penetrating Smell amongst all the Acids, they have endeavour'd by different Methods to extract it from this Mineral; the most ancient of which, and the only one, put in Practice amongst the Pharmaceutick Operators, and which remains to this very Day, is the Operation per Campanam (or by the Glass-Bell,) wherefore it is called, Spiritus Sulphuris per Campanam; others give it the Name of Oleum Sulphuris per Campanam, founded upon that old, but mistaken Axiom, that an Oil is nothing else but a liquid Sulphur, and that the Sulphur is but a coagulated Oil. And not finding any Acid Menstruum, able to dissolve the Mineral, nor daring to venture to mix the sulphureous Acid (which has the same

constitutive Principles as that of the Vitriol, the inflammable Part excepted) with an Alkali, from which they knew must necessarily result an Enixe Salt, they, for fear of losing the Acid by that Mixture, (the Publick not being acquainted at that Time with the Use of the concentrated vitriolick Acid, the only one, that can drive out all the other Acids) were led to try it by the general (but destructive) Manner of Separation of all sublunar Beings, viz. the open Fire (having perhaps been before convinced, that the only Action, perform'd by the Sulphur, when committed per se to the Fire in occluso, is too sublime (without losing its internal Cohesion) into a Body of the same Shape, Taste, Colour, Smell, and all other external Circumstances, which it had before, but in a purer Degree; 'till after several Emendations, they approved of the aforesaid, and very well known Operation per Campanam. The Liquor they got in this Way, being very little, it was sold at so high a Rate (notwithstanding its small Usefulness, as being destitute of its volatile Part, and therefore not better, than a common Oil of Vitriol) that only rich Persons could make Use of it. At last, the learned Dr. Stahl, having look'd nearer into the Matter, he found that it was impossible, that an open Bell (for, if there was not a little opening, the Sulphur would not burn) should retain the volatile Parts of the Brimstone, without the Intervention of a proper Subject, that could lay hold of it:

There-

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Therefore he made Use of the alkalious Rags (of which I shall take farther Notice in this Essay) and obtain'd by that Method both a more volatile acid Spirit, and in a larger Quantity; but as he did persist in burning the Sulphur, it is easy to conceive, that he still left this Process exposed to the same Inconvenience of losing in the open Air, not only a vast Quantity, but also the most volatile Part (in which consists its valuable Quality) of the sulphureous Acid.

It is true, that notwithstanding my continual Application to analytical Improvements in Chemistry, and the clear Idea I have always had, that the only Method of preserving the volatile Acid of the Sulphur, must be to keep it from the open Air; yet it was some Years before I was happily convinced, that to put the Sulphur into a Flame must be to take away all Hopes of Success in my Attempt; and that consequently I must lay aside Burning, if I would Operate in a close Vessel, and save the most volatile Part. And as I was thoroughly acquainted, by a long Experience, with the Manner of managing our Champions, the Acid and the Alkali; I saw, that if I would cause an internal Separation of the Brimstone, I must mix it with an Alkali, as the only Method to divide the Sulphureous Acid by Attraction from its former Terra Alkalica, with which it was united. Having thus

B 2

operated

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operated according to my Principles, I met at last with this easy, cheap, and speedy Method of extracting the sulphureous Acid, in a remarkable Quantity, and bringing it to the highest Volatility hitherto known; and was greatly satisfied with this happy Opportunity to facilitate to the Publick, such an useful and much wanted Remedy, which formerly by Reason of the Exorbitancy of its Price (tho' not answerable to the expected Efficacy) could not reach to the middling Sort of the People, much less to the Poor. But as my only View is to procure the Benefit of the Publick, and as I am not so much abandon'd to a vicious Self-love, as to flatter myself, that my Productions could not be subject to many Mistakes, I honoured myself by presenting this Essay, previous to its Publication, to the penetrating Inspection of the Royal Society: I hope, therefore, the Reader will receive it with the same good Intention as I have had in communicating it; and that it may invite others (especially in this happy Country, possessed (perhaps more, than any other) of a numerous Youth, fitted for Chemical Enquiries, not only by their Capacities and easy Situation at Home, but also by their good Inclinations for a Life of Business and Learning) to make further Discoveries, not only in regard to the Sulphur (whose Secrets, I believe, with many great Authors, are still of a vast Extent) but also to extract new

Re-

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Remedies for relieving Mankind of these new Diseases, under which we now labour : Seeing, that it has not been impossible to extract out of such mean and contemptible Ingredients, as Brimstone, Ashes, and Quick-Lyme, (and that in such a plain, short, easy, and cheap Way, that it now may be performed by any one at Home, and without being a Chemist) such a powerful and hitherto unattainable Remedy, as the volatile Acid of the Sulphur, which, for so long a time, had been so very expensive, and had been managed in a Method so inconsistent with the End proposed, that it has necessarily frustrated the Expectation of the Physicians.

And as I chiefly Design this Treatise for the Beginners in Chemistry, as an Analogick Model, by which to perform other Analytical Experiments ; and as I know, that some of them do believe that this Art (Chemistry) is full of numberless and almost invincible Difficulties, to a remarkable Injury to that Progress, which without these frightful Conceptions of it, they might make in it ; I think myself obliged, in Favour of the Truth, to assure them, that Chemical Operations require only length of Time, and consequently a good deal of Patience, to which the Chemist must, by all Means, inure himself, and, as every other Business requires common Care, Reason, and good Sense, to conduct each Process suitable to the Nature of the Subject, I would observe,

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observe, that he must know whether the Subject is of the acid, or of the alkalious Kind ; and must have a good Notion how to manage analytically such a Body, as the Operator works upon : and then, tho' those, who have but a slender Notion of Chemistry, may be apt to fancy it somewhat mysterious, and more difficult to acquire, than many other practical Sciences ; yet, a little further Acquaintance with it, will shew it to be as easy, as common experimental Philosophy.



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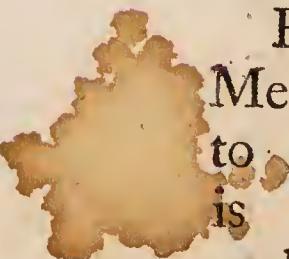
A N E W
IMPROVEMENT
In the A R T, of making the
True VOLATILE SPIRIT
O F
S U L P H U R.

C H A P. I.

Of the Sulphur and its Spirit.

THE Way to reduce *Sulphur* into an acid Spirit or Oil, (as it is called) has been sought hitherto by many, but found by few. Most made it in Glass-Bells, but got very little that Way; for the Glasses being quickly hot, could not hold the volatile Parts, so that it went away in a Smoke; some thought to get it by Distilling, others by Dissolving; but none have ever yet been able to bring

bring it to such Perfection, as to answer their Expectations : For which Reason many have been inclined to believe, that there is no Difference between the common *Oil of Vitriol* and the *Spirit of Sulphur*, though there is in reality a great one betwixt them, as will appear to every one who carefully considers them ; and this every skilful Physician will readily own. This is also the Reason, that it is scarce any where found genuine ; and that in the Shops of the Druggists, Chemists, and Apothecaries, *Oil of Vitriol* is usually sold instead of it ; since they think that there is no Difference between them ; as, indeed, there is none according to the present Preparations of it. Nevertheless *Oil of Vitriol* is not to be compared in Virtue to the *true Spirit of Sulphur*, which is not only of a more pleasant and a more volatile acid Taste, but also of greater Efficacy ; and therefore is of great Use both in Physick and Metallurgy, as in all hot and malignant Fevers and Diseases, &c. and in bringing some Metals into beautiful Crystals.



But, before I undertake to lay down my Method, which I think (though I am ready to submit to others of superior Judgment) is one of the easiest and best Ways of making the Spirit, I shall first mention something of the Subject, the *Sulphur*, itself. I shall shew, What the *Sulphur* is in *itself*? What it is *not*? And by that means a Person may

may know, what, and how much, there may be got out of it: And what, and how much, there cannot be got.

It is certain, that *Sulphur*, properly so call'd, *Every single Ingredient essential to Sulphur ought not to be called Sulphur.* consists principally of two Things; namely, of an acid Salt, that is to say, of the *Acidum Vitriolicum*, and of an inflammable Principle.

These two Things are absolutely necessary to be together, if the *Mixtum Sulphur*, or what we call *Brimstone*, can, with Propriety, be denominated such: But when, on the contrary, one of these two Ingredients, either the inflammable, or the saline Part, separately is mixed with other Bodies, (from which Mixture are produced other *Mixta*, *Composita*, *Decomposita*, and *Super-Decomposita*, which may be varied many thousand Ways, either by the Proportion of the absolute, or of the relative Quantity, and, consequently, produce as many different Things; of which mix'd Bodies there are many thousands in the World, either artificial or natural:) And when these Bodies which have only one single *Constitutivum*, or Ingredient of the *Sulphur* in them, are called *Sulphurs*, (which is too often the Case) the very Name confounds us, and we not knowing exactly what the *Sulphur* is, leads us into many wrong Conceptions of the *Sulphur* itself: Wherefore, I say, when the Name of *Sulphur* is properly applied to a Subject, that Subject must necessary be compounded of those two

A new Improvement in making the beforemention'd Constitutiva, namely, the Acidum Vitriolicum, and the Principium Inflammabile.

What Sense or Propriety would there be in calling *Spiritus Vitrioli*, or the *Acidum Concentratum Vitrioli* (namely the *Oleum Vitrioli*,) which is one of the Principles, whereof the *Brimstone* is compounded, *Sulphur*, or *Brimstone*? This would be a very odd Way of speaking ; and we might, with as much Propriety, call common Water, or Oil, Spirit of Wine, since it is very well known in the Art of Chemistry, that these two in an intimate Conjunction one with the other, produce a Spirit of Wine, or a *Spiritum Ardentem*.

It would be equally ridiculous, and as contrary to all Justness and Propriety to call many Subjects *Sulphur*, which Subjects, perhaps, have only one Ingredient of the *Sulphur* in them, namely, the *Inflammable*: Notwithstanding which, such Subjects still go under the Name of sulphureous Subjects. The better to illustrate this Point, I shall instance in some other Subjects.

Semen Lycopodii, *Bitumen*, &c. *Soap*, *Sal Ammoniacum*, and the *Cinnabaris*.

Every Body knows, that Soap consists of Fat, or Grease, and *Sal Alkali*; but would it not be very improper to call either the *Sal Alkali* by itself, or the Fat, Soap, tho' when they are both intimately mix'd, they constitute that Subject, which we call Soap? And so in

in regard to the *Sal Ammoniacum*, no body would call the *Sal Volatile Urinosum Alkalium*, when it is by itself *Sal* and *Ammoniacum*; and much less the *Spiritus Salis* by itself; altho' when these two are duly mix'd together, they produce the very Subject itself, the *Sal Ammoniacum*. But no Man of Sense or Reason would understand, by one of these single Words, the whole Subject. In the same Manner is it with the *Cinnabaris*; would ever any one understand me, as speaking of the *Cinnabaris*, when I speak only of the *Brimstone*, which is one of its Ingredients? or ever take the other Ingredient, the *Quick-silver* for it? altho' when they are both intimately mix'd together, they make up the whole Subject, the *Cinnabaris*. Why, therefore, do any speak so improperly, as to call other simple Subjects, *Semen Lycopodii Resinam*, *Therebinthinam*, &c. *Sulphur*, or sulphureous Subjects, which are only inflammable Subjects, and consequently consist only of one of the Ingredients of which *Sulphur* is compounded? Because, they'll say, it burnt like *Sulphur*: But this is not a sufficient Reason to call them *Sulphur*; because Spirit of Wine, and all essential Oils, Fat, and such like Matter, will burn: But it does not hence follow that they are *Sulphur*, but only that they have that single inflammable Ingredient, of which indeed, by a proper Addition of the other Subject, namely, the

A new Improvement in making the Acidum Vitriolicum, there may, at last, be produced the right Subject, or the true Sulphur.

*An Ob-
jection an-
swer'd.*

But say some, does not the *true Sulphur* burn ? and so does the Spirit of Wine, and all essential Oils, and Fat ; and consequently must not these be sulphureous Bodies ? But to this I answer, that this alone is no Proof of their being sulphureous Bodies ; if it was, by Parity of Reason, we might say, because Spirit of Wine, when we wash our Hands with it, wets them, and so does Water, Vinegar, Wine, Beer, Urine, Whey, Brine, &c. consequently, all these with which we wash our Hands, must be also Spirit of Wine. Besides, *Sulphur*, by which I mean what ought in reality to be called *Sulphur*, has particular specifick significant Properties ; which specifick significant Properties, are, undeniably, these that follow ; namely, *true Sulphur* is hard, of a dry Substance, easy to break, and cracks, when it is held in one's Hand ; has a penetrating suffocating Smell and Fume ; when melted, sublimates into a dry Powder, which we call *Flower* ; and is also sumblimable in its whole *Miscela*. I ask whether the oily Substances above mentioned have these Properties ? Besides the *true Sulphur* has many other significant Properties, not to mention any Thing of the *Acidum Minerale*. And if Oil, Fat, and those other inflammable Bodies which burn in the Fire, were *Sulphur*, then might the *true Sulphur*, likewise be converted by Art into Oils, which I never could bring it to,

to, nor ever heard of any one, that could produce out of a hundred Weight, one single Dram of an inflammable Oil.

Others again say, that Oils, Gums, Rosins, Pitch, and other fatty inflammable Bodies, as well of the Vegetable as of the Animal Kind, are called *Sulphur*, or sulphureous Subjects, for this Reason, only, because they participate of the *Sulphur*, not that these Subjects are the real *Mineral Sulphur*; and that therefore they are called *Sulphura Vegetabilia*, or *Sulphura Animalia*, that they may be known from the common *Mineral Sulphur*. But to this I answer.

1. As there is no Reason at all to call any Thing *Sulphur* that is not so; and much less to call some of these so, which cannot be changed, even by Art, into *Sulphur*; it, *a fortiori* follows, that nothing ought to be called a *Sulphur*, but the *Sulphur Minerale*, because there is no other in the World; and as soon as we talk of a *Sulphur Vegetabile*, or a *Sulphur Animale*, we talk of a *Non-Ens*.

2. There is no Occasion for the Use of *Tropes* in Chemistry. It tends, only, to create much Confusion; and, I think, that we have more Particulars in the *Chemic*, than we ought to have, and that it would be far better, if we could bring many of them under a general Head: For how improper is it to speak of a *Totum*, when at the same Time, a *Pars*, only is meant? Why are not all coloured Stones called *Terra Colorata*, and many other thousand

A new Improvement in making the

thousand Subjects, which are impregnated with the *Principium Sulphureum, Sulphur?* or why are not *Alum Tartarum* and *Sal Mirabile Glau-beri*, all which have a great deal of the *Acidum Sulphureum*, called so too? No, this they can-not be, because, we are told they do not burn like *Sulphur*: To which I answer, that, tho' they do not burn like *Sulphur*, which is only for want of the inflammable Part, or the *Phlogis-ton*, yet they have a great deal of the other constitutive Part of it, namely, of the *Acidum Sulphureum*.

*The Name
of Sulphur
is not to be
given to a
single In-
gredient.*

Wherefore, I think, it would be very con-venient, as it would prevent all Confusion in the Art of Chemistry, that no Subject what-soever, that participates only of one single In-gredient, or constitutive Part, belonging to the *Sulphur*, should be called a *Sulphur*. A Body indeed in which the *Sulphur* is in Reality, and from which it may be separated by Sublima-tion, may be so called. But if it is a Subject in which there is only one Ingredient, as, for In-stance, a Subject, in which the inflammable Part is the Basis, such a Subject may be called by the Name of *Principium Sulphureum*.

And so a saline Subject, in which the *Acidum* is the Basis, or greatest Part, may be called by the Name of *Acidum Sulphureum*.

Doctor Beccher was the very first, that we know of, who had a true Idea of the *Princi-pium Sulphureum*, and he called it, *Terra Secun-da, Terra Ignescibilis, vel Terra Inflammabilis*; but

but Doctor *Stahl*, who has much illustrated *Beccher's Physick*, gave it the Name of *Principium Inflammabile*; which I think, may likewise be call'd *Igniferum*, and all Bodies, that burn with a Flame, may well be so called.

This Principle is in its original Nature of a *Terrea Indoles*, or of an earthy Nature: And for this Reason, I think it is that Dr. *Beccher* has called it by the Name of *Terra Secunda*. The inflammable Principle is *Terra Indolis.*

This *Terra Secunda*, is by the Almighty Creator, endued with this Property, that when mix'd or united with other Bodies, it disposes them to Inflammability; wherefore, it is the Basis, or Foundation to all inflammable Bodies, that are in the World: It not only has Inflammability it self, but it also disposes other Bodies, which have it not, to be combustible, when mix'd with it, and that in such a Manner, as in burning to emit a Flame; wherefore I think, that Dr. *Stahl* has given it the most proper Name; in calling it, *Principium Inflammabile*, or *Terra Inflammabilis*.

The more to illustrate this, Dr. *Stahl* gives the following Account of its Combinations and Productions. Explanation of the Principles.

1. He says: If the *Terra Secunda* is mix'd with the *Terra Prima* and united with a little Water, the Production of it is a *Bitumen*. But if the *Terra Secunda* is mix'd with a great deal of Water, and there is but little of the *Terra Prima*, and these three are intirely well united, then the Production of it is an Oil, such an Oil Instances of some mix'd Bodies produced by these Principles.

A new Improvement in the making

as the *Oleum Petræ*, or *Naphta*;) but if to the first of these Mixtures (which produces a *Bittumen*) is added a little more of the *Terra Prima*, and a little more Water, then the Production will be a *Sulphur*: And, again, if the *Acidum Universale* is mixed with the *Terra Secunda*, then the Production will be the *Acidum Nitrosum*, &c.

The inflammable Principle is the Cause of the Colour and Smell.

The Cause of all Metals and Minerals, and their Malleability, and Ductibility.
The Phlogiston can never be shewn separately, or by itself: but as soon as it is separated from that Subject with which it was before united, it goes into another Body.

2. Moreover, it is this *Principium Sulphureum*, which is the *Causa Coloris* and *Odoris*: So that a Person may safely conclude, that in every Body, that is not of a white Colour, and has a sulphureous Smell, that the Original of its Colour and Smell is the *Principium Sulphureum*.

3. This Principle is the *Causa Metalleitatis, Malleabilitatis, Ductilitatis, and Splendoris Metallici*.

This, also, is to be observed, that this *Phlogiston*, as it is an *active Principle*, cannot be shewn separately, or by itself, any more than any other of the physical Principles can be shewn: Because, as soon, as it is separated from the Body, with which it was united, (which can easily be done, by the Art of Chemistry) it either goes, immediately, into another Body, and forms a new Mixture, or else it is so rarefied, that it flies away in the open Air, as the Camphire, or other *Salia Volatilia* do by exposing them to the warm Air: And after it is so united with the Air, it is there carried on with the Motion of the Air, and comes again, either

either with Snow, Rain, or Dew, and is the only Thing by which all Vegetables are nourished.

How the common *Sulphur* is made, or separated for Ores, &c. and how it is afterwards sublimed, and refined, I have no Occasion to mention ; because these are so well known by every Body. The only Things I shall mention, are some few significant Qualifications, by which the common *Sulphur* is to be distinguished,

1. A right and depurated *Sulphur* ought to crack, just as if it was to split in Pieces, and then to leave a particular Smell behind in the Hand.
2. A true *Sulphur* ought not to unite, or to mix with Water, Spirit of Wine, or Oil.
3. When it is burned, it ought not to leave any Soot, or footy Fumes, but what produce a strong sour Spirit, which is of a strong suffocating Smell.
4. It ought to unite with all fix'd Alkali Salts, and to be of a liver-colour'd Substance.
5. And as soon as it is precipitated out of such a fix'd Alkali Solution with a sour *Menstruum*, it ought to change into a white Precipitate, which may, by a Sublimation, be reduced to *Sulphur* again ; and ought, during the Time of Precipitation, to deliver a stinking Smell, much like rotten Eggs ; and the

D

Fumes

A new Improvement in making the Fumes that arise from it, do generally change Silver black.

6. It generally blackens Metals, and destroys them.

7. It changes all Metals into Minerals: Yea, even the Gold itself, it, in some measure, destroys.

8. It generally makes all Metals brittle, except Silver, which seems to be made more malleable by it.

9. It generally changes crude Mercury and Arsenick: When mix'd in the Fire with red hot Iron and Copper, it goes into a yellowish Ore; with the Silver it may be brought into a glassy Ore; Lead and Sulphur melted together, may be brought into a Sort of black Lead; it brings the *Regulum Antimonii* into its former Substance.

*Of what
the common
Sulphur
consists.*

The common Sulphur does, therefore (according to what has been said above) consist of two Things, and is, in short, a dry mineralick *Concretum Terreo-salinum Inflammabile*, and its greater Part is the *Acidum Vitriolicum*; from whence it is evident that it consists only of two Things.

*The Proportion
of the
two Prin-
ciples.*

The Proportion of these two constitutive Parts is very remarkable, and deserves a very particular Consideration: Dr. Stahl proves in one of his Treatises about the Sulphur, that there is no more in one Pound of Sulphur, than sixty Grains of the inflammable Ingredient

dient (*Ingredientis Inflammabilis*,) and that at the same Time there is about fifteen Ounces and six Drams of the acid Ingredient, or of the *Sal Acidum*. And this is true in Fact. For Dr. *Newman* has, as well as Dr. *Stahl*, told us, in what Manner it may *experimenta-*
liter be demonstrated, which has already been mention'd in Dr. *Cranmer's Art of Es-*
saying Metals, Page 388 to 390, and is as fol-
 lows : "Take of very pure Flowers of Sulphur one Part, of a very fine dry *Sal Tar-*
 " *tari* two Parts, mix them very well to-
 " gether in a dry warm Mortar, fill a Crucible with this Mixture, cover it with a phur.
 " Tile, and put it into a Fire of a middling
 " strength ; the Mixture will soon melt. Put
 " it next into a clean dry Iron Mortar, and
 " with all possible Care scrape of what ad-
 "heres to the Crucible ; then beat the whole
 " to a Powder ; divide these into two equal
 " Parts in a Pair of Scales ; roast one Part of
 " it in a clean Plate or earthen Vessel, not
 " glazed, first with a gentle Fire, which must
 " be increased more and more, 'till the Ves-
 " sel grows middling red-hot ; stir now and
 " then with a Tobacco-Pipe, taking great
 " Care in the mean while, that no Ashes
 " fall into it, least the Weight should be false-
 " ly increased : If the Salt grows quite white,
 " and no longer emits any Smell, it is a Sign,
 " that the *Phlogiston* is dissipated ; the Acid
 " of the *Sulphur* will adhere to the remain-

A new Improvement in making the

“ ing fix'd Salt, one Part whereof has turned
“ to a Tartar Vitriolate, out of which it can-
“ not be expelled by Fire alone. Weigh the
“ remaining Salt ; dissolve the other Portion
“ of the Liver in a Glass-vessel with a treble
“ Quantity of pure Water, there will remain
“ a brown Sediment, which will be *Sulphur*,
“ not quite dissolved by the Alkali ; put up-
“ on this Solution the strongest Spirit of Vi-
“ negar, Drop for Drop; a white Powder will
“ be precipitated, which is called *Lac Sul-
“ phuris*, or Milk of Sulphur : Stir up the
“ Liquor, and put it quite turbid into a fil-
“ tring Paper ; when it is all gone through,
“ put again upon it Spirit of Vinegar, Drop
“ for Drop; that in Case more of the *Lac
“ Sulphuris* is again expelled, it may be
“ joined to the foregoing, by repeating the
“ Filtration : What gathers in the filtering
“ Paper, being dry, if you distil it out of
“ the Retort, it will afford *Sulphur*. Thence
“ it appears, how much *Sulphur* was hidden
“ in the first Portion before the roasting.
“ But as the Acid of the *Sulphur* remain'd
“ along with the first Portion, after the in-
“ flammable Part was dissipated, it is cer-
“ tain, that the Excess of the Weight of
“ the extracted Salt, by which it surpasses
“ half the Weight of the Alkaline Salt em-
“ ploy'd, proceeds from thence ; and this
“ Excess of Weight shews of course, how
“ much Acid there is in the *Sulphur*, which
“ you

" you have got by Precipitation and Sublimation : Thus you find, that the Acid is about fifteen Times more weighty than the *Phlogiston*. We are hereby inform'd, that Part of the *Phlogiston*, having left its Acid, is at that Time dissipated ; and that on this Account, more Acid is attributed to the remaining *Sulphur*, expelled with Vinegar, and purified by Sublimation, than it has in reality : Whether, and how much Tartar Vitriolate it contains ; which is found out by Edulcoration with warm Water, and by the Diminution thus made in the Weight of the dry'd Residue ; because the Tartar Vitriolate being already produced, in the Liver of *Sulphur*, would remain with the *Lac Sulphuris* in the filtering Paper, as a Salt very difficult to be dissolved : Therefore as much Acid as is adherent to such a Weight of Tartar Vitriolate, so much are you to substract from the Increase of the Weight."

It may be made in another Manner, and may also be reduced into *Sulphur* again, out of the Tartar Vitriolate : By which means it may be known, what Quantity of Acid the *Sulphur* contained, of which this Vitriolate Tartar was made. ----- Namely, take a certain Quantity of *Flores Sulphuris*, and a certain Quantity of quite dry *Sal Tartari* : Set down the Weight of each by itself upon a Piece of Paper ; then put the *Sulphur* into a Crucible,

How to find out the Quantity of Acid and the inflammable Principle of the Sulphur, by making the Vitriolate Tartar into Sulphur again.

A new Improvement in making the

Crucible, which stands in a gentle Fire, so that the *Sulphur* melts but very slow, then put in by degrees, a little at a Time, of the *Sal Tartari*, 'till the *Sulphur* is entirely saturated (and give it rather too much than too little 'till such Time as it comes into a *Hepar Sulphuris*). Then let it cool, and afterwards take the *Hepar* out of the Crucible, as neat as possible you can, and weigh it by itself, and at the same Time weigh the *Sal Tartari* that is left, by itself, and then write down the Weight of each by itself upon a Piece of Paper; and you may see, by comparing the former single Weights to these :

1. What Quantity of *Alkali* the *Sulphur* did take to its Saturation ? And,

2. You may know by adding the Weight of the produced *Hepar*, and the remaining Weight of the *Sal Alkali* together, whether there be, by the Conjunction, any Thing of the *Sulphur* lost or wasted, and how much it is.

The Hepar contains the whole Sulphur with its Acid and Phlogiston Parts.

In this *Hepar* there is the whole Quantity of *Sulphur*, if it be well made, as well the acid, as the *Phlogiston*; and by both together is retained the third Body, namely the *Alkali*. Now, if you want to know what Quantity of *Acid* there is in this *Hepar*, then you must put it (namely the *Hepar*) into a flat earthen Dish, and after that set the Dish upon a slow Fire, and then with a little Glass, or Iron-rake, rake it backwards and forwards, in

in the same Manner, as they are used to do when they calcine Antimony for the *Vitrum Antimonii*, or as the Potters do when they calcine their Lead in order to Glaze their earthen Ware : Then the inflammable Part, will, by Degrees, fly away (or that which Dr. Stahl calls *Materia Inflammabilis, seu Phlogiston*) and the *Sal Acidum*, or the acid Part, will remain united with the *Sal Alkali fixum*. You may know when all the *Phlogiston* is dissipated, by the Smell ; then let it cool, and afterwards weigh it again ; by which means you will find how much of the *Phlogiston* there was in the *Sulphur* : So that in this Way you come to the Knowledge of these two Things.

You know how much of the inflammable Matter such a Quantity of Sulphur had, or contain'd : Which is the very Weight, that this *Hepar* lost by the last Calcination : And what Quantity of Acid there was in such a Quantity of *Sulphur*, i.e. so much as the Weight is more than the *Sal Alkali*. We also see that the *Sal Acidum Vitriolicum*, which is commonly so prodigious hard to be drove out, that a Fire of 700 Degrees can scarce drive it out, goes up with the last Degree of Heat, when it is in Conjunction with the *Phlogiston*. For common *Sulphur*, when you set it on Fire, in a while it will consume away, and leave but very little behind, and if it is clean, nothing at all.

We also see, that this *Sulphur* when disposed, or brought with the Help of an *Alkali* into a *Hepar*, and this *Hepar* is dissolved in Water, is entirely soluble. Yea, it is even fit to wash one's Hands with : And not only so, but will wet one's Hand without being dissolved with Water : Altho' the *Sulphur* when in its whole Substance, will neither wet the Hand, nor be dissolved in any liquid *Menstruum* whatsoever, except the liquid fixed *Alkali Salts*, as *Oleum Tartari per Deliquium*, &c.

But, amongst other Observations this is the most remarkable, and curious : That so little a Quantity of the inflammable Matter can keep, or involve such a Quantity of the acid Salt, and make it to be consumed by a little trifling Heat : Yea, what is farther to be observed, is, that it is capable of altering and disposing it at the same Time to such a Condition, that this which is the most principal Part, and the very Basis of the *Sulphur*, is not capable of shewing its principal Property, as it would and should do, if it was not united with it ; namely, to dissolve in Water, as all other Salts do, nor to shew its proper Qualifications, as other Salts do : For in Union with this, it tastes neither bitter, salt, nor sour ; neither alkaline, acid, nor acid acute ; nor does it look white as all other Salts do, and this would do, if it was by itself ; in short, it denies all *Actiones Acido-Salinas*.

If any Person should question the Truth of what has been said, or should doubt, whether an acid Salt, properly so called, (which when alone, has those Properties and Qualities; namely, which tastes bitter, sour, &c. is dissolvable in Water, and is of a white Colour, &c.) can be brought by Art into such a Body, or changed into such a Substance, as the *Sulphur*; and consequently question, whether there is such a Salt to be found in the *Sulphur*: I say, let him who questions this, only take that very neutral Salt, the *Tartarus Vitrilatus*, which is made out of that Water, in which the *Hepar* (which was made of the *Sal Alkali* and *Sulphur*) was dissolved, and put it into a Crucible, and give it a good glow, and then add to it some of the *Phlogiston*, or inflammable Matter, namely some Coal-Dust, and afterwards melt it and distil it in *Occluso*, and he will get a *Sulphur* by Sublimation.

This very thing has caused many to doubt, whether there ever could be produced real *Sulphur* by Nature, and to think rather that the *Sulphur* was first produced, when through Art the Minerals were roasted, or calcined with Wood; amongst which Professor *Hoffman* is one who affirms, that no *Sulphur* was ever produced without the Addition of the Coal-Dust, which it received from the Wood, with which the Ore was calcined: But this does not hold good, for where has the *Sulphur Vivum*, as it is called, or *Sulphur*

*Some have
doubted of
the natural
Production
of the Sul-
phur.*

Naturale seu Griseum, received its inflammable Matter, which is some Times dug out of the Earth without being ever calcined ? And besides, where do our *English Pyrates* receive their *Phlogiston*, which taken out of the Sea, and carried on Shore, without being calcined, only by being distilled in *Aperto Igne*, delivers a *Sulphur* as soon as it is come out of the Sea ?

It is true, Professor *Hoffman* is so far right in this, that it happens very often, that there are Ores, which do not deliver a *Sulphur*, before they are calcined with Wood : But these are only such Sort of Ores, as contain most of the *Acidum Vitriolicum*, and in which the acid keeps, or involves that little inflammable Part so close, that it cannot be drove out ; but by calcining it with Wood, it receives a good deal of the inflammable Matter from the Wood, by which Means the *Sulphur* is produced, or generated ; but this is to be observed, only in these vitriolick Ores, and it ought not therefore to be looked upon as absolutely true, that all *Sulphur* is produced after this Manner. Dr. *Stahl* gives the following Description of the *Sulphur*.

Dr. Stahl's Description of the Sulphur. 1. He says, no Body can doubt whether *Sulphur* is a *Mineral Concretum*, because it is digged out of the Earth, and cannot be produced by Art, out of any other *Regnum*, without the Addition of the *Regnum Minerale*.

2. It is plain, that it is a dry Substance, which is neither wet, fat, clammy, nor of a liquid Consistence.

3. He has called it a *Concretum Terreo-Salinum*, but not a Salt. A *Concretum Salinum* it may be called, because he can prove, that the greatest Part of it consists of saline Parts; but it does not from hence follow, that it is altogether a Salt; for it neither melts in Water, nor has any saline Taste; and of this the inflammable Matter is the Cause; for it is so compounded of that Part which he calls *Terra secunda Beccheri*, or of the inflammable Ingredient, that it keeps it from all Water (in the same Manner, as the *Partes Oleosæ* keep the *Succinum* together,) and hinders almost every *Menstruum* from attacking or dissolving it.

4. He has called it a *Concretum Terreo-Salinum*, as it is entirely owing to the earthy inflammable Part (or to the *Terrea Indoles*) that it does not shew its saline Property, as it would do, if it was by itself; and that no body may imagine, that by calling it an earthy Concrete, is meant, that it is such a Concrete, as Chalk, Stone, &c. He specifies the whole Mixture of it in calling it a *Concretum Salinum Inflammabile*, by which he means a dry, earthy, saline, mineral, inflammable Body, which, in its whole Composition or Combination, is called *Sulphur*, and in English, *Brimstone*. This is not a *Mixtum Simplex*,

Simplex, but a *Compositum*, because it consists of two separate Things, which can be both separated the one from the other, and by Art can be compounded and brought together again into their former State, as may be seen both in analytick and synthetical Operations.

How to prove the Composition ex Analyysi.

5. We may see *Analytice* as plain as any thing can be seen, that the *Sulphur's* biggest Part is a *Sal Acidum*, or an *Acidum Vitriolicum*, when the *Sulphur* is mixed with a fixed *Alkali*, (as I have already mention'd) and separated from its inflammable Part, by which Means, you produce a *Tartarum Vitriolatum*, which will be in all respects like to that, which is made of the *Oleum Vitrioli*, and the *Oleum Tartari per Deliquium*.

How to prove it ex Synthesi.

6. This may also be seen *Synthetice*, or à *Componendo*; namely, after the common, and at present very well known Method, which is called Sulphurification, of which, I believe Sir *Robert Boyle* was the very first Discoverer, who at the same Time kept it very secret; but now it is more commonly known, since Dr. *Stahl* has not only discovered it, but has also given a very clear and plain Account of it, which is done by taking the *Acidum Vitriolicum*, either that which is separated from the *Sulphur* itself, or from another Body, and adding to it an inflammable Matter, or such a *Principium Inflammabile*, as the said Dr. *Stahl* calls the *Pblogiston*; and by this Way of Composition is produced a *Sulphur*.

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There are at present some who believe, as others in former Times did, that there is but one Substance, or one of these Ingredients to be found in the *Sulphur*, namely, the Acid one, and not the Inflammable ; the Nature of which Acid is, that it can burn, and is inflammable of itself : But these People have either no true Idea of the *Sulphur* itself, and of its Experiments, Resolutions, and Compositions ; or no Knowledge of the Quality and Properties of the Mineral Acids. Let them therefore, consider the two following Paragraphs, and I am persuaded they will soon quit this *chimerical* Notion.

1. Let them consider, that there is no *Sal Acidum in forma sicca in rerum Natura*, (in the whole World) and that the *Sulphur* acts not as a simple pure Salt, neither, as an impure Salt ; and therefore how can they imagine, that the *Sulphur* is nothing, but a simple Mineral Acid Salt ?

2. Let them only consider the Preparation, which is called *Lac Sulphuris*. For if the *Sulphur* was nothing but a Mineral Acid Salt, if there was nothing else in it, it would by a Conjunction with the *Sal Tartari*, be so closely united with it (when brought into a *Lac Sulphuris*) that no Acid whatsoever could force it from it, as is plainly the Case in the *Tartarus Vitriolatus* : But on the contrary, we find that it may be separated by a weak Vegetable Acid, namely, the *Acetum*, tho' it is

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an undeniable Truth, that it is impossible for a weak one by Strength, to force out a stronger.

And as this is a certain Rule, it would be impossible for such a weak Acid, as Vinegar is, to precipitate the *Sulphur*, which, nevertheless, it does in the abovementioned Cafe.

So again, there are a great many who entertain different Opinions concerning the inflammable Matter of *Sulphur*, and its Substance. Some imagine, that it is an Oil, or of an oily Nature: Others think, that it is a Sort of Rosin, or of a rosinous Nature: Others again say, that it is a Bitumen, or of a bituminous Nature; and many other strange and whimsical Notions there are of it. If it was of an oily Nature, or of a rosinous, or a bituminous one, we should be able by Art to separate from a great Quantity, for Instance, from a hundred Weight of it, a Dram or two, if not more, of a fat Substance: But I have not as yet known one in the World, who, with all his Art, could produce a Dram, or a Grain out of a hundred Weight of it. And farther, we should be able with a strong rectified Spirit of Wine, if not entirely to dissolve it, at least to extract some Thing out of it, which, by Experiments, we have found to be impossible: Nay, we know, that there is no such Thing to be produced, or drawn out of Charcoal,

coal, as fat, rosinous, bituminous, or oily Matter; and, I hope, that there are none, who do imagine, that there is any such Thing to be done; though there are many who know, that there may be produced with the *Acidum Vitriolicum*, and the Charcoal, a *Sulphur*; and this proves very plainly, that Dr. Stahl's Description of the *Sulphur* is right, that the inflammable Matter is nothing else but a *Substantia Terrea*.

It is very true, I must own, that there ^{A Sulphur} may be produced a *Sulphur* by mixing the *Acidum Vitriolicum* with all inflammable Things, as for Instance, with all vegetable and essential Oils, as well the distill'd as the pressed ones; with all Rosins, or rosinous Substances, with all Bitumens, and with all bituminous Matters; with Turpentine, Wax, Pitch, Tar, Wood, Flowers, Roots, Herbs, Barks of Trees, Seeds, Horns, Bones, Hair, Blood, Feathers, &c. In short, every Thing that is inflammable, be it what it will, is fit for Sulphurification: Yea, even the Spirit of Wine itself is fit for Sulphurification, if it is mixed with a proper Subject, and in a proportional Quantity of the Mineral Acid; but without that no *Sulphur* can be produced out of the abovemention'd. And I own, that when any of all the abovemention'd Matters are in a proper and proportionable Quantity mixed together with the *Acidum Vitriolicum*, and the Mixture is deliberately and care-

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carefully managed, there will be produced such a Mineral Saline Concrete, as the *Sulphur* is, which will not differ, in the least, from the natural one ; and let the inflammable Matter, herein mixed, be what it will, the Production will be all the same at last ; the Subject will be of the very same Texture and Colour.

*Inflammable Bodies
do not remain in
the Sulphur, but
only the
inflammable Parts
of them.*

But at the same Time, as I acknowledge this to be true, I do assert, that we must not imagine, that because we mix an Oil, or an oily Substance with the *Acidum Vitriolicum*, that that very oily Substance does remain in the *Sulphur* ; for, if this was the Case, the Horns, Bones, or the Hair, would also remain in it. A very strange Mixture indeed ! Have not we an Instance parallel to this in making Steel of Iron ? Do not there the Bones, Claws, or Horns, that we use, burn away, while the inflammable Matter goes into the Steel ? Would not those, who, being present at the making of Steel, should think to see the Bones, Claws, or Horns go into the Steel, be greatly disappointed, in seeing them all burnt into Ashes ? It is not here, as it is in Bacon fry'd in a Pan, and with some Eggs and Flower made into a Pan-Cake or Pudding ; there, indeed, the inflammable Matter of the Bacon goes into the Pan-Cake, and the Substance of the Bacon is at the same Time left in the Pan-Cake, as plainly appears in cutting it a-cross with

with a Knife: But this is not the Case in Sulphurification or Chalybification. On the contrary, by the Sulphurification nothing of that inflammable Matter comes into the *Sulphur*, besides the *Terra Inflammabilis*, or the *Principium Inflammabile*; and that is so entirely united with the acid Part, that there is no such Thing as separating it, and shewing it by itself; for in that very Moment, in which it is through Art disposed to separate, in that very Moment, I say, does it go *transumendo* into another Body.

Now, as I have given these plain and clear Ideas of the *Sulphur*, and have shewn what the *Sulphur* is, and what it is not; and by what Means any one, who has not a right Idea of the *Sulphur* may, according to this, know what there may be produced out of the *Sulphur*, and what there cannot; I shall advance farther, and speak of the *Spiritus Sulphuris*, which by many, for want of a right Knowledge of it, is called *Oleum Sulphuris*; which is a plain Proof, that the Reason of its having had the beforemention'd many Names given to it, is because it has been thought to consist of an oily Matter.

C H A P. II.

Of the Volatile Spirit of Sulphur.

TO get that Part out of the *Sulphur*, which we call the *Volatile Spirit of Sulphur*, has been very difficult, and has therefore, for some Ages ago, created much Fatigue, as well of Mind, as Body, and yet has not been brought to that Degree of Perfection, as has been expected; but what might the Reason of this be?

What has hindered the bringing of the volatile Spirit of Sulphur to that Perfection which has been desired. 1. A Thing was wanted to be got out of it, that was not to be found in it, namely, an oily Part.

2. It was not known what the Subject was that was worked upon: And how is it possible for any one to work well upon a Subject when he doth not know what it is in itself? And how can he who does not know what is in a Thing, know beforehand what can be got out of it? Every Operation, therefore, of this Kind was founded only upon Suppositions, and what was got from the *Sulphur* in these Operations, was owing more to mere Accident, than to Design. 'Tis true, a sour Oil, or Spirit, was imagined to be in it; but how much it was, or in what Part of the *Sulphur* it lay, was not known: But of later Years there have been some very worthy

Gentle-

Gentlemen who have examined the Matter more closely, and have invented several Machines in order to catch this volatile acid Part; but notwithstanding all their Machinery they have still lost their volatile Part, which they have principally endeavoured to get. And we have, at last, found, as they have got nothing volatile out of it, but only a four Spirit, that that Spirit has been nothing but the Oil or Spirit of Vitriol; which, indeed, I must own, has, at last, when it has been rectified, and dephlegmated, been nothing but a vitriolic Acid; and as they have been certain of the Truth of this, they have been absolutely discouraged from proceeding in such a chargeable Process, as that of the *Spiritus Sulphuris* has been; upon which Account, it is now almost quite out of Use, so that there are but very few that continue to make it: And, instead of it, they have used on those Occasions, in which it has been wanted, the *Oleum Vitrioli*, thinking, that that might do the same Service: But alas! there is a great Difference between these two, as will plainly appear by thoroughly examining them both. But before I speak any Thing of this Difference, I shall relate some few of the best Methods, to procure the greatest Quantity of *Spiritus Sulphuris*.

*The Reason
why the
Processes
have been
so trouble-
some and
tedious.*

What has made their Labour so hard, their Processes so tedious, and the Thing at last so very dear, has been:

1. That they knew no other Method of procuring the Spirit out of the *Sulphur*, but that of burning it. And,

2. They knew very well, that it could not be burned without being in the open Air; because if enclosed, the *Sulphur* will not burn.

3. Thus their tedious Work began; for as soon as the *Sulphur* was set on fire, and exposed to the open Air, the inflammable Part did directly volatilize the acid Parts, and whilst it was burning, rarified it to that Degree, that but little of it was saved or collected.

4. When they have, by a great deal of Labour, and in a long Time, collected some Spirit in this Manner, it has been intermix'd some Times, either with a great deal of Water, which has been added to it wilfully as a *Menstruum* to catch it, or with the Moisture of the Air, so that it has not been fit for use; wherefore they have been obliged to dephlegmate it several Times; and so at last they have got the Acid concentrated in the Bottom of the Retort, in which they dephlegmated it. Now, suppose there had been some of the volatile Part in it, and it had been dephlegmated but once; that lit-
tle

the volatile Part, or the *Gas* has all gone away during the Dephlegmation, so that nothing has been left behind, but the coarse heavy acid Part. The most useful Method of collecting it is by the Bell, from whence it has got the Name of *Spiritus Sulphuris per Campanam*; and these Bells, again, have been altered into a thousand different Shapes.

Amongst the best Methods of making the *Volatile Spirit of Sulphur*, I think, that which Mr. Homberg contriv'd, is one; by which he obtain'd five Ounces of this Liquor in twenty-four Hours, which is to be seen in the *Memoires de l'Academie des Sciences*, in the Year 1703. *Pag. 31.* and is as follows :

“ Take the biggest Receiver, you can get made; in which cut a circular Hole in the Bottom, of eight or ten Inches wide: In order to do this, with a Thread let down a leaden Bullet from the Mouth, and on the Outside mark the Point with a Diamond, where the Bullet rests at the Bottom. Upon this Point, as a Center, with a Pair of Compasses describe a Circle with Ink of ten Inches in Diameter; and when the Ink is dry, with a Diamond cut the Circle as deep as you can conveniently, the deeper the better; when this is done, take an Iron-ring of the same Size, as the Circle, which make red-hot, and apply to it, and the Piece will fly out, and leave “ the

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" the Bottom open; then with a proper
 " Glue round the Neck, glue on a Piece
 " of Canvas, that has Loops to it, through
 " which you may pass some Lines to the
 " Bell equally suspended; then take a Gal-
 " ley-Pot six Inches wide, fill this with pure
 " Sulphur, place it upon a glazed earthen
 " Stool, standing in a large glazed Dish,
 " that riseth in the Middle; and then hang
 " the Bell exactly over the Middle of the
 " Flame, and so near it, that it just suffers
 " it to burn, and no more; keep the Sul-
 " phur constantly and equally burning, by
 " continually adding fresh, and removing
 " the Crust with an Iron-Rod, if any is
 " formed, whilst it is burning, that by this
 " Means the Distillation may not be in-
 " terrupted."

This, I think has been one of the best
 Methods; for, though he could get but an
 Ounce out of a Pound, yet he could get in
 twenty-four Hours, by consuming five or six
 Pounds of Sulphur, five Ounces of Spirit.

But there have been those, who have
 known how to get twice this Quantity out of
 a Pound; tho' their Method of doing it, I am
 not acquainted with. One *Cornelius Drebbel*,
 a great Mechanick, had certain Machines ad-
 apted to that Purpose, in which he could
 produce out of a Pound, eight or ten Ounces,
 of pure *Acidum Sulphureum*: I wish that he
 had left his Machines to the Publick, when
 he

he died, for then there might have been made more Improvements upon them; but he kept the Secret so close, that it died with him.

Another certain Person affirms, that he was able, by cohabiting the *Sulphur* with several *Menstruum*s, to change almost the whole Mass of it into a sharp corrosive acid Liquor. Amongst other things, he says, that he has put Spirit of Nitre, and *Aqua Fortis* to the *Sulphur*, by which Means he has disposed it into a sour Spirit, which he has got in Quantity, and was very like to the *Oil of Vitriol*; he says farther, that he has taken a strong Spirit of Nitre, and put it upon a good Quantity of fine *Flores Sulphuris*, and put them together in a Glass-Retort, and set in a Sand-pan, in which he had Ashes instead of Sand, and so has drawn off the Spirit from the *Sulphur*; and this he has contrived with cohabiting and distilling it off again, five or six Times, 'till at last he had disposed the *Sulphur* to a sour Liquor, which he says, was very like to that which is made by the Bell: Nay, he says, he believes, that if he had continued the Cohabitation and Distillation with new Spirit, three or four Times more, he should have disposed all the *Sulphur* (except that little earthy Matter, which it has) into an entire sour Oil. *Vide the Philosophical Transactions abridg'd by John Lowthrop*, Vol. II. Page 544.

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This indeed sounds very well, and those who do not know the Nature of the Sulphur, would be apt to make it a *Volatile Spirit*, after this Process; but that very Gentleman has not looked into the Nature of the Thing, not thinking, that the *Spiritus Nitri* is of a Nature quite different from that of which the Sulphur is; and that the *Spiritus Nitri* is by far a much weaker Acid, than the *Acidum Sulphureum*; and therefore, if he had only examined his *Spirit*, he would have found what a great Difference there was, between that and a *true Spirit of Sulphur*:

Dr. Stahl was the very first who searched by Analogy into the Nature of the Sulphur, and he found that all the known Methods were only a Parcel of tiresome and tedious Operations; he, therefore, laboured to invent a new Method, by which to procure this Spirit in Quantity, and at the same Time to preserve Part of its Volatility; which might very reasonably be expected from him, since he who knew the Subject so perfectly well, could not fail to find out a proper Method; and his Method was as follows :

*Dr. Stahl's
Method.*

He made several Aludels, or conical Papers, such as the Papers round a Sugar-Loaf, and put five or six on one another, which were all open at the Top, except the last; then made a strong *Lixivium* of Pot-Ashes, in which he laid a great many Linnen Rags, till all the *Lixivium* was soaked up in them, and

and then he took these Rags, and hung them in the Aludels, one above the other ; and then he put into a Pipkin a Parcel of *Sulphur*, which he melted, and set it on Fire ; and then he put all these Aludels over the Pipkin, in which the lixivious Rags were hung, and so he let the *Sulphur* consume by Degrees; by which Means, as the *Sulphur* did consume, the Acid went into the alkalized Rags, and there it united with the alkaline Salt, and was kept from flying away. Now as fast as those Rags were saturated and dry, they were taken out, and fresh ones hung in their Places, 'till such Time as he had gathered such a Quantity as he thought proper : Then he took all his Rags together, and washed them in Water ; the Water he evaporated away, 'till the united Salt became dry ; when he had got a pretty large Quantity of this inspissated neutral Salt, he put it into a tubulate Retort, and then he put the Retort into a Sand-Heat, and luted on a Receiver ; and then he put by Degrees into the Retort thro' the Tube, the same Weight of *Oleum Vitrioli*, as there was of the neutral Salt ; when all was put in, he luted the Tube fast, and gave it a Fire, by which Means the *Acidum Vitriolicum* got hold of the *Sal Alkali*, and drove out the volatile Part of the *Sulphur*, whose Acid was not so strong as the other :

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By this Means he procured the Quantity of volatile acid Spirit, which was in it. At the Bottom of the Retort he had a neutral Salt, which he dissolved and crystallized, and is the *Tartarus Vitriolatus*.

*Deficiency
of Dr.
Stahl's
Method.*

This was the best Method of procuring the *Volatile Spirit of the Sulphur*, and is the most useful of any that have been hitherto known. But this Process is not only very tedious, but delivers very little; and which is still worse, though the Spirit is with so much Nicety catched, yet all its Volatility is not saved; which is the only thing we are seeking to preserve, that it might have its desired Effect, and do that Service which is expected from it, where it is used; because, if its Volatility is gone, wherein all its best Virtue consists, it is not fit to enter, as it must, in order to remove all Acridities, those narrow Passages, thro' which it would otherwise go, and which such a coarse acid Spirit is not capable of passing.

This has, therefore, caused me to seek how to preserve its whole Volatility, and at the same Time to procure it in Quantity, and with Ease; and in endeavouring to do this, I have deeply weigh'd and consider'd the Matter, and have tried several Methods, amongst which I have found the two following to excel:

No.

No. 1.

R. *Florum Sulphuris ℥j.*
Salis Alkali siccii ℥v.
M.

No. 2.

R. *Florum Sulphuris ℥j.*
Salis Alkali fixi ℥ivß.
Calcis Vivaæ ℥ij.

I have tried both these Processes, and each of them in several Proportions; but I have found these Proportions to be the best: Because by the Process No. 1. I have found, that it is absolutely necessary to use ℥v of *Sal Alkali* in order to dissolve ℥j of *Sulphur*: But the other Process, which contains ℥ivß of *Sal Alkali* to ℥j of *Sulphur*, will do (and the Quick-Lime being strong, ℥iv of *Sal Alkali* will be enough;) because the *Calx Viva* makes the *Lixivium* as strong again. Either of these Processes will answer, and both will deliver the same *Volatile Spirit*. Nevertheless, I have found some Difference in the Quantity, and in the Volatility; for that which is made with the *Calx Viva*, delivers less Spirit, but much stronger, and of more Volatility, than that which is made only with the *Sal Alkali*. Another Difference there is in the *Caput Mortuum*; for that *Caput Mortuum*, which

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is left of the Spirit, made with the Quick-Lime, is a great deal whiter, and more crystalline, than the other, and fitter to be used in making the Vitriolated Tartar. In the first Place, I mix the *Sulphur* and the *Sal Alkali* by themselves, very well together, and then I put this Mixture into an Iron-Pan, putting first as much Water to it, as would just dissolve the *Sal Alkali*; then I disposed it to boil a little, by which Means the *Sal Alkali* had more Power to lay hold of the *Sulphur*: When I had thus boiled it for a Quarter of an Hour, I put more Water to it, and put the Quick-Lime to it, and so I let them boil together for a little while. When I thought a good deal of the *Sulphur* was dissolved; I took the clearest off, and filtered it; and then I put in more Water, and so proceeded with the Elixivation and Filtration (in the same Manner, as in making the *Lac Sulphuris*) 'till I thought, that all the *Sulphur* was dissolved; then I put all these clear and filtered lixivious Waters together in an Iron-Pan, and evaporated them there, 'till the Remainder became somewhat dry, and then I dry'd it as much as possibly I could in the Pan, 'till I found, that the *Sulphur* was almost ready to melt; after which I let it cool, and took it out, and laid it in a Glass tubulate Retort, and set the Retort in a

Sand-

Sand-Heat, having luted on a Receiver before; and then I put by Degrees into the Tube of the Retort ℥j of the best rectified Oil of Vitriol: When all the Oil was in, I secured the Glass with a Stopple of Chalk, and luted it; gave a gradual Fire for some Hours, 'till all the volatile Spirit of *Sulphur* was gone over; then I let the Fire go out, and took off the Receiver, and put the Spirit carefully into a Vial. The Spirit was very volatile, and weighed eight Ounces, and some Drams; which Drams I will not take Notice of, because sometimes I have had four, sometimes six, and sometimes less, which I apprehend, is occasioned by some Fault in the *Lutum*. But now, if you will make the Spirit after the Process No. 1. you must add to your lixivious Salt (which weighs about ℥vj after it is well dry'd) ℥ij of the best rectified Oil of Vitriol, and then according to this Method it will deliver twelve Ounces of volatile Spirit: But, I do not find, that this Spirit is so volatile, or so Heavy, as that which is made with the Quick-Lime, or that the *Caput Mortuum* of this is so white as that of the other.

Sometimes a little of the *Sulphur* will sublime in the Neck of the Retort; but this happens only, when you force the Fire too soon in the Beginning, or when the Oil of
Vitriol

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Vitriol is not strong enough ; but this is of no Signification.

*Observa-
tions.*

N. B. I have found if you mix ℥ij of *Sal Alkali* at first with the *Sulphur*, and add ℥ij of it with ℥ij of *Calx Viva* to it, after the first has once been boiled up, and filtered, that it sooner dissolves the *Sulphur* than if you put in the whole Quantity at once, and the same is to be observed after the second Filtration, in putting the rest of the *Sal Alkali*, and the Quick-Lime to it, and so continuing the Elixivation and Filtration, 'till all the *Sulphur* is dissolved.

This is my Method, which is very plain, and is the most proper, and easy Method to preserve the Volatility of the *Sulphur*, and to procure the greatest Quantity of the volatile Spirit, in the shortest Time that has yet been known ; because

*Demonstra-
tion of my
Method.*

1. The *Sal Alkali* gently dissolves the *Sulphur*, and divides its Parts so minutely, that it is afterwards very easy with a stronger *Menstruum* to drive it out.

2. The Quick-Lime makes the *Lixivium* as strong again ; by which Means you save ℥ij of *Sal Alkali*, and besides the Spirit will be a great deal more volatile, and the *Caput Mortuum* will be quite white and crystalline, like the *Caput Mortuum* or the *Sal Mirabile Glauberi* : But this is very remarkable, and well

well worth observing, that by this Method with the Quick-Lime you do not get that Quantity of Salt out of it (after it is elixivated and inspissated) which you do out of that, which is dissolved by the *Sal Alkali* only; for, with the *Sal Alkali* and *Sulphur*, the inspissated lixivious Salt weighs $\frac{1}{2}$ vij which is the whole Quantity of *Sulphur* and *Sal Alkali* which was put in; but that which is dissolved with the same Lime and *Sal Alkali*, produces only $\frac{1}{2}$ vij of lixivious Salt, after it is inspissated, which is $\frac{1}{2}$ vij, less than what the *Sal Alkali* and *Sulphur* weigh'd, which was put to it in the Beginning.

3. It preserves the *Sulphur* entire, so that none of the volatile Parts, nor any of the *Materia Inflammabilis* can exhale, which, in reality, is the *Cafe*, according to Dr. Stahl's Method; for though, as I must own, *that* was a very speedy Method of getting the volatile Spirit of the *Sulphur* yet; it could not be done, according to this Method, without setting the *Sulphur* on fire; and though he had this alkalick *Lixivium* to catch it in, yet it cannot with Reason be thought, that it would all go into the lixivious Rags; for a great deal, if not the greatest Part of it, would fly away, and vanish: Because, as I have mentioned before, as soon as the *Materia Inflammabilis* has catched Fire, it rarifies and subtilizes the

Acid

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Acid to that Degree, that there is hardly any Vessel that has Pores close enough to keep it, was it even possible to burn *in Occluso*; but, as it must be burned in the open Air, much less is it to be expected that all should be got. Whereas, according to my Method, it cannot fail of being all preserved; because the alkalious *Lixivium* immediately lays hold of the *Sulphur*, and that without any Degree of Fire, that can dispose the *Sulphur* to burn, till such time as all is dissolv'd, that is to say, till it is so minutely divided by the alkalious Salt, and so involved with it, that the *Sulphur* is fit to penetrate, and pass through the subtle Pores of the Paper in a liquid Form; and in this Manner it is kept and preserved, with its whole Volatility, till it becomes dry again; and then if you should give it ever so strong a Degree of Fire, you can scarce make it lose any of its Acid; but if any Thing should be lost, it would be some of its *Pblogiston*, or of the *Materia Inflammabilis*, which, indeed, is one of the principal Things, we ought to endeavour to preserve; and, therefore, we must not give it a glowing Fire, after the *Lixivium* becomes dry, but must take it out before it comes to that Degree of Heat, and immediately put it into the Vessel in which it ought to be.

There

There may be some, who, having not a thorough Knowledge of *Menstruum*, and of their Operations one upon another, may make this Objection :

1. Would not the Oil of Vitriol, which *Objection.* you put upon it, come over? and then it would not be a pure *Spiritus Sulphuris*, since it would be mixed with the Oil of Vitriol; so that we might as well use the Oil of Vitriol by itself. To which I answer, that this Objection betrays want of Knowledge in those who make it, as the following will clearly prove.

It is very well known, by all those who are acquainted with *Menstruum*, that to drive out a strong one, there must necessarily be a stronger; that is to say, if any given *Menstruum* is united with any given Body, that *Menstruum* that shall separate it, and drive it out, must either be stronger in itself, or it must have a nearer Affinity than the given Body has, to that in which it is to go, and with which it is to be united, in order to cause it to drop, and let go that with which it was united before. Is not this the Case in Precipitation? If you want to precipitate any Metal, which is dissolved in an acid *Menstruum*; must you not look for such a Body to precipitate it with, which has a nearer Affinity to that *Menstruum*, than the

*A new Improvement in making the dissolved Metal has? For Instance; If you have dissolved Silver in *Aqua Fortis*, and you want to have the Silver out again; must not you look for a Body, to which the acid *Menstruum*, namely, the *Aqua Fortis*, has a nearer Affinity, than to the Silver, and by uniting with which, it drops the Silver? So, again; if you want to have the Copper precipitated out of it, you must look for another Body, to which the acid *Menstruum* has a nearer Affinity, than to the Copper; and therefore, as the *Terra Martis* is of a sweeter Nature than the *Terra Veneris*, by putting the Iron into it, it drops the Copper, and unites with the Iron. So also, if you want to have this *Terra Martis* precipitated out of it, you must look for a Body to which the acid *Menstruum* has a nearer Affinity, than to the Iron; and, therefore, as the Zink, or the *Terra Zinci* is sweeter, and has a nearer Affinity to the acid *Menstruum*, than the *Terra Martis*; by putting the Zink into the Solution of Iron, it drops the Iron, and lays hold of the Zink: But, if you want the Zink to be precipitated out of it, you must look for another Body, to which the acid *Menstruum* has a nearer Affinity than to the Zink; and here, as the *Lapis Calaminaris* is of a more alkaline Nature than the Zink, by putting in the *Lapis Cala-**

Calaminaris it will lay hold of that, and drop the Zink : But, if you want to have the *Lapis Calaminaris* precipitated out of it, there is no other way to do this, than to make use of those Bodies, to which all Acids have the nearest Affinity ; and those are the alkalius Bodies, either volatile or fixed, though the latter are the best ; and when they are united with this acid *Menstruum*, there is no *Menstruum* or Fire in the World, that can separate them ; which is plainly the Case in the Enixe Salts, as in the *Tartarus Vitriolatus*, &c. which will endure the greatest Torture of Fire, and yet not be separated.

But may not the Objectors say ? This is no Answer to our Objection, which was, that the Oil of Vitriol would come out, when urged by the Fire, and so spoil the *Spiritus Sulphuris* : To which, I answer, that the Instances I have given above are exactly parallel to the Case before us ; and that there is no more Difference between them than this, viz. that in the former, the Bodies are precipitated and got into a solid Form ; and that in the latter, the *Spiritus Sulphuris* is distill'd, and goes over into a liquid Form : And this is as well done by the Strength of a *Menstruum*, as by its Nearness of Affinity ; as the following In-

stances will plainly make appear: There are no more than four acid *Menstruum*s in the Universe, which are, 1. The essential ones, such as the *Acetum Succus Citri*. 2. The *Acidum Salis Communis*. 3. The *Acidum Nitrosum*. And, 4. The *Acidum Vitriolicum*.

Now, if you take a fixed *Alkali*, and saturate it with an essential Acid, and afterwards put it to a proper Quantity of the weakest *Acidum Minerale*, viz. of the *Acidum Salis*, (I say, a proper Quantity, because if you take too much, some of the *Acidum Salis* may go over) and put it into a Glass-Retort, and set it in a Sand-Heat, and give it a proper Degree of Fire, you will see that the essential Acid goes over, and not a Drop of the *Acidum Salis Communis*.

So, if you want to have the *Acidum Salis Communis* out again, you must put in a stronger Acid than that is; put therefore a proper Quantity of the *Acidum Nitrosum* upon the Remainder, and put it into a Sand-Heat again, and give it a proper Degree of Heat, and you will see that the *Acidum Salis Communis* goes over, and not the *Acidum Nitrosum*. The Reason is, because the *Acidum Nitrosum* is a stronger Acid than the *Acidum Salis Communis*. And this is a standing Rule, that a strong one (if it is left to take

take its own Course, without being artificially hindered from so doing) will drive out a weaker one. But, if you want to have the *Acidum Nitrosum* out again, you must put a proper Quantity of the *Acidum Vitriolicum* upon the Remainder, and proceed in urging the Fire as before ; and you will see that the *Acidum Nitrosum* will go over, and not the *Oleum Vitrioli*, and will leave a neutral Salt behind it, which is called the *Tartarus Vitriolatus* ; and this Acid is not to be separated from it again by any Strength, either of *Menstruum*, or of Fire.

Does not this hold good in making the *Spiritus Nitri Fortis* with the *Oleum Vitrioli*? It will, therefore, hold equally good in my Process, in making the *Spiritus Sulphuris*; for as long as the *Acidum Sulphureum* is in Union with the *Materia Inflammabilis*, it is of a more volatile Nature, than the *Acidum Vitriolicum*: Therefore, if there is added a proper Quantity of the *Oleum Vitrioli* to it, it is preserved, and kept entire by the *Sal Alkali*; and being distilled with a proper Degree of Fire, it will be forced to leave the *Sal Alkali*; and then the *Acidum Vitriolicum* goes into its Place, and unites, and remains fix'd with the *Sal Alkali*.

But some may object, and say ; since it is affirmed, that it is the volatile Part of the Sulphur,

*Difference
between
the Gas,
and the true
volatile Spi-
rit of Sul-
phur.*

A new Improvement in making the Sulphur, as every skilful Physician must own, that must perform those great and wonderful Cures in malignant Fevers, or pestilential Distempers, in which the Alkaline Acrid, or the *Materia Peccans* (the thick and crude *Pus*) makes such cruel Havock, and Devastation; might not the *Gas Sulphuris* do the same Service, since it has Part of a Volatility as well as the *Spiritus*? To which I answer, No: For, though, as I must own, what is called the *Gas Sulphuris* is a Part of the most volatilized *Sulphur*; yet at the same Time, it differs in some thousand Degrees from the other; for this *Gas* is nothing but an impure Phlegm, which is got by the Distillation of Vitriol, and consequently contains very little, or none at all of the acid Part, but only a little of the volatile Part, intermix'd with the wild phlegmatick Fumes of the Vitriol; and, therefore, if it stands a while, those wild volatile Parts will exhale; and nothing will be left, but the impure Phlegm. On the contrary, the *Spiritus Sulphuris*, made according to my Method, has not only its whole Volatility preserved, but, at the same Time, has in it the most pure and subtle Acid, that can ever be obtained; therefore, though it should happen to lose its Volatility, by ones carelessly leaving the Vessel open, yet it cannot possibly lose its Acidity.

Now,

Now, it is very well known, that all malignant Fevers have their Original from a Superfluity of volatile alkaline Salt in the human Body; by which such *Materia Pecans*, as we see in the Small-Pox, is created; and which, by the Heat of the Body, is forced out to the extreme Parts of the *Cuticula*; and that all Pestilences proceed mostly from one or the other of the following Causes.

1. Dead Carcasses of Men, Horses, or Cattle slain, and putrifying above Ground by Heat and Moisture, and throwing their noxious Particles, and infinitely small volatile urinous alkaline Salts, through the Atmosphere.

2. Dead Fishes thrown out of the Sea, and putrifying on the Shore; or Clouds and Swarms of dead Insects, bred in Fens and hot marshy Countries, as Caterpillars, &c. drown'd in the Ocean, and thrown on the Shore by the Tide in scorching Climates; which, when putrified and fermented by Heat and Moisture, send forth an Atmosphere of active urinous Salts.

3. Cloth, Raggs, animal or vegetable Substances, taken from Persons dying of a Plague, and saturated with such infectious, or deleterious Particles, which stream or exhale from them.

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4. Bad Food, *i. e.* putrified, rotten, and too minutely divided Flesh, abounding with detached urinous and volatile Salts.

5. Mineral, arsenical and poisonous Damps, Vapours, or Exhalations, arising from Vulcanees, Grottoes, Ruptures, or Mines, and occasioned by subterraneous Heat and Fermentation.

Upon exact Search and Enquiry, one or other of these five will invariably be found to have been the natural Cause of all the Plagues or pestilential Distempers, that have ever been in the World; they can, therefore, proceed only from a high Exhalation, Volatilization, and Sublimation of the urinous animal Salts; which being hard, porous, and alkaline, but filled with a like caustick and ætherial Oil, whereby their Velocity and Elasticity increases, become small, volatile, and highly attractive, and by their Effervency (like Barm in Wort) soon rend and tear, and putrify the Solids, break the Cohesion of the Fluids, and destroy animal Life, which is soon done on such as live high.

I say therefore, that all epidemical Infections, and eruptive Distempers, are but less Degrees of pestilential ones, caused by these animal, alkaline Salts, weaken'd and diluted.

The Itch arises from the same animal Salts of a more coarse, dull, and less deleterious Nature, encouraged by Nastiness, as Vermin is bred in close damp Rooms. The small Pox are the first Elements, or lowest Degree of the Plague or Pestilence ; and the great Pox are the same, but only more condens'd, and concentrated ; and thus, by an easy and natural Piece of Philosophy (which I cannot flatter myself of being dñly acquainted with ; and, therefore, I leave it to those learned and worthy Gentlemen, whose Profession and Improvements qualify them to make farther Enquiries of this Kind) all epidemical Infections and pestilential Distempers may be accounted for.

And as most, if not all, of the very worthy Gentlemen of the Faculty will, I suppose, own, that this is the real Cause of those Distempers ; so, if they intend to cure them, it must be done by the *Contrarium*, which is a volatile acid *Menstruum*, fit to penetrate through the minutest Parts and Pores, and there to destroy the acrid, alkaline, peccant Matter ; for which, I think, this volatile Spirit of *Sulphur* is the most fit and proper of all the Things, that are known in the whole *Materia Medica* ; and that this is an undeniable Truth, that those Distempers must be cured by Acids, is plain from hence ; that in the present War, there was sent out with

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the Fleet a great Quantity of Vinegar to wash the Decks of the Ships with, in order avoid Infection.

These are the Improvements of my Preparation of the *Volatile Spirit of Sulphur*; to which more might be added about its Uses, as a *Menstruum*, and particularly with regard to Pharmacy, as in making the *Elixir Vitrioli*, &c. acidulating Juleps; and answering all the principal Ends of an Acid; but having a Mind to finish this Essay, I submit it to the candid, and judicious Reader, desiring of him this Favour, that he would endeavour to set me right in any Thing, in which, he thinks, I am mistaken.

F I N I S.

